

Diagnosis of Latent Tuberculosis Infection

CONTENTS

Quick Start Check List	7.2	
Introduction.....	7.4	
Purpose.....	7.4	
Policy	7.4	
Forms.....	7.4	
Tuberculosis Classification System	7.5	
High-Risk Groups	7.6	
Diagnosis of Latent Tuberculosis Infection.....	7.8	
Mantoux tuberculin skin testing	7.8	
		Candidates for Mantoux tuberculin skin testing
		7.9
		Administration of the tuberculin skin test.....
		7.12
		Measurement of the tuberculin skin test
		7.14
		Interpretation of the tuberculin skin test
		7.15
		Human immunodeficiency virus screening.....
		7.17
		Follow-up activities
		7.17
		Chest radiography
		7.17
		Resources and References.....
		7.20

Quick Start Check List: Diagnosis of Latent Tuberculosis Infection

This check list is designed to assist public health nurses when evaluating a patient for latent tuberculosis infection. The tasks below should be performed by licensed nursing, medical, and laboratory staff. This check list requires understanding the instructions in the manual and familiarity with local protocols and standing orders. Forms are available at <http://www.dphhs.mt.gov/PHSD/epidemiology/epi-tuberculosis-forms.shtml> .

Tasks for Diagnosis of Latent Tuberculosis Infection	Instructions and Forms
Determine whom to test	<p>Instructions:</p> <p>For persons who are not part of a contact investigation:</p> <p>Section 7: Diagnosis of Latent Tuberculosis Infection</p> <p>Topics: High-Risk Groups, Candidates for Mantoux Tuberculin Skin Testing</p> <p>For persons who are contacts:</p> <p>Section 10: Contact Investigation</p> <p>Topics: Quick Start Check List; Contact Evaluation, Treatment and Follow-up</p>
<p>Conduct tuberculin skin testing:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Place and measure tuberculin skin tests (TSTs) <input type="checkbox"/> Interpret TSTs: <ul style="list-style-type: none"> ▪ 5 mm is positive for persons who are contacts or immunosuppressed ▪ 10 mm is positive for persons with recent infection or clinical conditions of increased risk ▪ 15 mm is positive for persons at low risk ▪ Skin test conversion: For persons previously skin tested, an increase in induration of 10 mm or more within a two-year period is classified as a conversion to positive. <input type="checkbox"/> A positive reaction to tuberculin in a Bacille Calmette-Guérin-vaccinated person indicates infection with <i>Mycobacterium tuberculosis</i> when the person tested <ul style="list-style-type: none"> ▪ Is a contact of another person who has infectious tuberculosis (TB) ▪ Resided in a country with high prevalence of TB ▪ Had continuous exposure to populations in which the prevalence of TB is high 	<p>Instructions:</p> <p>Section 7: Diagnosis of Latent Tuberculosis Infection</p> <p>Topics: Administration, Measurement, and Interpretation of the Tuberculin Skin Test</p> <p>Forms:</p> <ul style="list-style-type: none"> ▪ "TB Contact Investigation Report" <p>Note 1: Anergy testing is not recommended</p> <p>Note 2: For diagnosing latent TB infection (LTBI), improved blood tests called interferon gamma release assays (IGRAs) will be available in 2007. The QuantiFERON®-TB Gold (QFT-G) test and other interferon gamma release assays (IGRAs) are not currently available in Montana. For more information, contact the Montana TB Program at 406-444-0275</p>

Tasks for Diagnosis of Latent Tuberculosis Infection	Instructions and Forms
<p>Screen for human immunodeficiency virus (HIV):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Screen all persons in the following groups: <ul style="list-style-type: none"> ▪ Persons at risk for HIV ▪ Persons younger than 5 years, or ▪ Persons who have a clinical condition such as silicosis, diabetes mellitus, chronic renal failure, some hematologic disorders (e.g., leukemias and lymphomas), other specific malignancies (e.g., carcinoma of the head or neck and lung), weigh loss of greater 10% body weight, gastrectomy, and jejunioileal bypass 	<p>Instructions:</p> <p>Section 7: Diagnosis of Latent Tuberculosis Infection</p> <p>Topic: Human Immunodeficiency Virus Screening</p>
<p>Exclude active pulmonary TB disease:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Obtain chest radiography for patients with positive TST results. Chest radiography is indicated for all persons being considered for treatment of latent TB disease (LTBI) 	<p>Instructions:</p> <p>Section 7: Diagnosis of Latent Tuberculosis Infection</p> <p>Topics: Follow-up Activities, Chest Radiography</p> <p>Note: Tuberculin-positive persons with normal chest radiographs and no symptoms are candidates for treatment for LTBI.</p>
Tasks for Follow up of Patients Diagnosed with Latent Tuberculosis Infection	Instructions and Forms
<p>Determine whether to treat the patient for LTBI</p>	<p>Instructions:</p> <p>Section 8: Treatment of Latent Tuberculosis Infection</p> <p>Topics: Quick Start Check List, Whom to Treat</p> <p>Recommended Form:</p> <ul style="list-style-type: none"> ▪ "LTBI Medicine Enrollment Form: State Provided Medicine Application" (use when ordering from the state program only)
<p>Follow up patients who are contacts in a contact investigation</p>	<p>Instructions:</p> <p>Section 10: Contact Investigation</p> <p>Topic: Contact Evaluation, Treatment, and Follow-up</p>
<p>Assure that all persons with abnormal chest radiographs and/or symptoms of TB disease are evaluated for TB disease</p>	<p>Instructions:</p> <p>Section 7: Diagnosis of Latent Tuberculosis Infection</p> <p>Topics: Follow-up Activities, Chest Radiography</p> <p>Section 5: Diagnosis of Tuberculosis Disease</p> <p>Topics: Quick Start Check List</p>

Introduction

Purpose

Use this section to understand and follow national and Montana guidelines to

- classify patients with latent TB infection (LTBI)
- diagnose LTBI

In the 2005 guideline “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America,” one of the recommended strategies to achieve the goal of reduction of TB morbidity and mortality is the identification of persons with LTBI at risk for progression to TB disease, and treatment of those persons with an effective drug regimen.¹



Contacts are mentioned within this section, but their evaluation and follow-up are covered in more depth in the Contact Investigation section. For information on treatment, refer to the Treatment of Latent Tuberculosis Infection section.

Policy

In Montana:

- Contacts should be evaluated as described in the Contact Investigation section.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

Forms



To identify required and recommended forms, refer to the “Quick Start Check List: Diagnosis of Latent Tuberculosis Infection” in this section. Required and recommended forms are available on the “Montana Tuberculosis Forms” Web page at <http://www.dphhs.mt.gov/PHSD/epidemiology/epi-tuberculosis-forms.shtml>

Tuberculosis Classification System

The system for classifying tuberculosis (TB) is based on how the infection and disease develop in the body. Use this classification system to help track the status of TB in your patients and to allow comparison with other reporting areas.

TABLE 1: TUBERCULOSIS CLASSIFICATION SYSTEM²

Class	Type	Description
0	<ul style="list-style-type: none"> No tuberculosis (TB) exposure Not infected 	<ul style="list-style-type: none"> No history of exposure Negative reaction to the tuberculin skin test (TST) or interferon gamma release assay (IGRA)
1	<ul style="list-style-type: none"> TB exposure No evidence of infection 	<ul style="list-style-type: none"> History of exposure Negative reaction to the TST or IGRA
2	<ul style="list-style-type: none"> TB infection No disease 	<ul style="list-style-type: none"> Positive reaction to the TST or IGRA Negative bacteriologic studies (if done) No clinical, bacteriologic, or radiographic evidence of TB disease
3	<ul style="list-style-type: none"> TB disease Clinically active 	<ul style="list-style-type: none"> <i>Mycobacterium tuberculosis</i> complex cultured (if this has been done) Clinical, bacteriologic, or radiographic evidence of current disease
4	<ul style="list-style-type: none"> TB disease Not clinically active 	<ul style="list-style-type: none"> History of episode(s) of TB Or Abnormal but stable radiographic findings Positive reaction to the TST or IGRA Negative bacteriologic studies (if done) And No clinical or radiographic evidence of current disease
5	<ul style="list-style-type: none"> TB suspect 	<ul style="list-style-type: none"> Diagnosis pending

Adapted from: CDC. Classification system. In: Chapter 2: transmission and pathogenesis. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm>. Accessed July 3, 2006.

High-Risk Groups

Certain factors identify persons at high risk for tuberculosis (TB) infection and/or for progression to TB disease. Persons in the high-risk groups listed in Table 2: **Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease** are candidates for tuberculin skin testing in Montana.

Persons with risk factors from both columns may be at much higher risk than those with risk factors in only one column. For example, an individual born in a high-TB-prevalence country with HIV infection is at much higher risk of having active TB than a US-born individual with HIV infection.

TABLE 2: PERSONS AT HIGH RISK FOR TUBERCULOSIS INFECTION AND PROGRESSION TO TUBERCULOSIS DISEASE³

For Tuberculosis (TB) Infection	For Progression to TB Disease ⁴
<ul style="list-style-type: none"> ▪ High-priority contacts such as housemates or coworkers, or contacts of persons who have smear-positive pulmonary or laryngeal tuberculosis (TB) ▪ Infants, children, and adolescents exposed to adults in high-risk categories ▪ Recent immigrants (primarily <5 years) from countries with high incidence of TB (Asian, African, Latin American, and Eastern European countries have TB rates 5–30 times higher than U.S. rates, and an increasing percentage of TB cases in the United States are occurring among immigrants from those countries) ▪ Residents and employees of high-risk congregate settings (e.g., correctional institutions, nursing homes and other long-term care facilities providing care to high-risk residents and clients, and homeless shelters) ▪ Some healthcare workers who serve high-risk clients, especially emergency departments, staff involved in high-risk procedures, and laboratories manipulating TB cultures ▪ Some high-risk racial or ethnic minority populations, defined locally as having an increased prevalence of TB ▪ Some medically underserved, low-income populations as defined locally (e.g., homeless, transient populations) ▪ Persons who inject illicit drugs; any other locally identified high-risk substance abuse users 	<ul style="list-style-type: none"> ▪ Persons with HIV infection ▪ Infants and children aged <5 years ▪ Persons infected with <i>Mycobacterium tuberculosis</i> within the previous 2 years ▪ Persons with a history of untreated or inadequately treated TB disease ▪ Persons with radiographic findings consistent with previous TB disease ▪ Persons who use alcohol or illegal drugs (such as injection drugs or crack cocaine) ▪ Persons with any of the following clinical conditions or other immunocompromising conditions: <ul style="list-style-type: none"> • Silicosis • Diabetes mellitus • End-state renal disease (ESRD)/chronic renal failure, hemodialysis • Some hematologic disorders (e.g., leukemias and lymphomas) • Other malignancies (e.g., carcinoma of head, neck, or lung) • Body weight $\geq 10\%$ below ideal body weight • Prolonged corticosteroid use • Use of other immunosuppressive treatments (e.g., prednisone or tumor necrosis factor-alpha [TNF-α] antagonists) • Organ transplantation • Gastrectomy • Chronic malabsorption syndromes • Jejunioileal bypass

Source: Adapted from: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):4–5; CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):7–9.

Diagnosis of Latent Tuberculosis Infection

Mantoux Tuberculin Skin Testing

The Mantoux method of tuberculin skin testing is used to detect infection with *Mycobacterium tuberculosis*.

In general, it takes 2 to 10 weeks after infection for a person to develop a delayed-type immune response to tuberculin measurable with the Mantoux tuberculin skin test (TST).⁵ During the test, tuberculin is injected into the skin. The immune system of most persons with tuberculosis (TB) infection will recognize the tuberculin, causing a reaction in the skin. Repeated TSTs do not produce hypersensitivity.

The size of the measured induration (a hard, dense, raised formation) and the patient's individual risk factors should determine whether TB infection is diagnosed.⁶ Based on the sensitivity and specificity of the purified protein derivative (PPD) TST and the prevalence of TB in different groups, three cut-points have been recommended for defining a positive tuberculin reaction:

- Greater than or equal to 5 mm
- Greater than or equal to 10 mm
- Greater than or equal to 15 mm of induration⁷



For more information on cut-points for the TST, see the “Interpretation of the Tuberculin Skin Test” topic in this section.

Note: For diagnosing latent TB infection (LTBI), improved blood tests called interferon gamma release assays (IGRAs) will be available in 2007. For more information, contact the Montana TB Program at 406-444-0275.

Candidates for Mantoux Tuberculin Skin Testing

The Mantoux TST can be administered to all persons, including pregnant women,⁸ persons who have previously been vaccinated with Bacille Calmette-Guérin (BCG),⁹ and human immunodeficiency virus (HIV)-infected persons. However, persons with a documented prior positive TST do not need another TST, and the Mantoux TST should not be administered until four weeks after vaccination with live-virus vaccines.



If the person being tested is a contact, follow the procedures outlined in the Contact Investigation section.

Pregnancy

Tuberculin skin testing is entirely safe and reliable for pregnant women, and pregnant women at high risk for TB infection or disease should be tested. Screen pregnant women for TB infection if they have any of the following conditions:

- Symptoms suggestive of TB disease
- HIV infection
- Behavioral risk factors for HIV
- Medical conditions other than HIV infection that increase the risk for TB disease
- Close contact with a person who has pulmonary or laryngeal TB disease
- Immigration from an area of the world where incidence of TB is high

Bacille Calmette-Guérin Vaccine

BCG vaccines are live vaccines derived from a strain of *Mycobacterium bovis*. Because their effectiveness in preventing infectious forms of TB has never been demonstrated in the United States, they are not recommended as a TB control strategy in the United States, except under rare circumstances. They are, however, used commonly in other countries. A history of BCG vaccination is not a contraindication for tuberculin skin testing, nor does it influence the indications for a TST. Administer and measure TSTs in BCG-vaccinated persons in the same manner as in those with no previous BCG vaccination.

Diagnosis and treatment of LTBI should be considered for BCG-vaccinated persons with a TST reaction of equal to or greater than 10 mm induration, especially if they are

- continually exposed to populations with a high prevalence of TB (e.g., some healthcare workers, employees and volunteers at homeless shelters, and workers at drug treatment centers);

- born or have lived in a country with a high prevalence of TB; or
- exposed to someone with infectious TB, particularly if that person has transmitted TB to others.¹⁰

Evaluate these patients for symptoms of TB. If a patient has symptoms of TB disease, obtain chest radiography and (if the patient is coughing) collect sputum specimens.

Bacille Calmette-Guérin Talking Points

1. Tuberculin reactivity caused by BCG vaccination wanes with time but can be boosted with a TST.¹¹
2. There is no method to distinguish TB tuberculin reactions caused by vaccination with BCG from those caused by mycobacterial infections.¹²
3. A diagnosis of *M. tuberculosis* infection should be considered for any BCG-vaccinated person who has TST reaction ≥ 10 mm of induration.¹³
4. Treatment for LTBI should be considered for a person who is TST positive and has previous BCG vaccination if the person is:
 - A contact of infection TB or
 - Vaccinated and born in or resided in a country of high prevalence of TB or
 - Exposed to persons at risk for TB¹⁴
5. BCG vaccination should be considered for infants and children who reside in high morbidity countries to prevent meningeal TB.¹⁵
6. There is no scientific evidence of protective ability of BCG for preventing pulmonary TB in adolescents or adults.¹⁶

Anergy Testing

Anergy testing is not routinely recommended in conjunction with TST for any patients, even those infected with HIV.

Factors limiting the usefulness of anergy skin testing include the following:

- Problems with standardization and reproducibility
- Low risk for TB associated with a diagnosis of anergy
- Lack of apparent benefit of treatment for LTBI in groups of anergic HIV-infected persons¹⁷

Documented Prior Positive Tuberculin Skin Test

Persons who have tested positive in the past and can provide documentation of their status should not have another TST. Instead, they should have a TB symptom assessment questionnaire administered to identify any symptoms of TB disease.¹⁸ Persons who are symptomatic should receive a chest radiograph.

Live-Virus Vaccines

The Mantoux TST can be administered in conjunction with all vaccines. However, the measles (MMR) vaccine—and possibly mumps, rubella, varicella, and live attenuated influenza vaccines—may transiently suppress the response to PPD.¹⁹ Therefore, if a vaccine containing live virus (e.g., measles, smallpox) has already been given, the TST should be deferred until (or repeated) at least four weeks after the vaccine was administered.

When giving the TST and the MMR, one of the following three sequences should be used:

- Apply the TST at same visit as the MMR
- Delay the TST at least four weeks if the MMR is given first
- Apply the TST first and then give the MMR when the TST is measured²⁰

Multiple Puncture Tests

Multiple puncture tests (MPTs), such as the Tine test, should not be used. The MPTs are not reliable because the amount of tuberculin injected intradermally cannot be precisely controlled and there is no standard for interpretation.

Administration of the Tuberculin Skin Test

The TST should be placed by a healthcare worker who has received appropriate training and is following written protocols.

TABLE 3: BEFORE YOU BEGIN TO ADMINISTER A TUBERCULIN SKIN TEST

Before You Begin to Administer a TST	
Review Information	<p>CDC. <i>Mantoux Tuberculin Skin Test Facilitator Guide</i> at http://www.cdc.gov/tb/pubs/Mantoux/guide.htm</p> <p>Infection control procedures (including hand washing before and after the procedure and the use of gloves and a sharps container)</p>
Gather Equipment	<ul style="list-style-type: none">▪ Gloves▪ Alcohol pads or alternative skin cleanser▪ Safety needle▪ Tuberculin syringe (Do not pre-draw tuberculin into syringes prior to test.)▪ Purified protein derivative (PPD) (Tubersol® or Aplisol®: See the warning in the text below in this table.)▪ Sharps container <p>Note: Opened PPD tuberculin vials must be dated and discarded after 30 days. See the package insert for appropriate storage information.</p>



Read the PPD labels carefully before administering a TST. The packaging of tetanus toxoid-containing vaccines (TTCVs) is similar to Tubersol® and Aplisol®, and all are refrigerated. See the CDC's "Errors Involving Mix-up of Tuberculin Purified Protein Derivative and Vaccine Products" (*TB Notes Newsletter*. 2005;No. 1) at http://www.cdc.gov/tb/notes/TBN_1_05/Errors_mix_up.htm.

How to Administer a Tuberculin Skin Test

1. If the patient's written consent is required, obtain it, per health department requirements.
2. Inject air into the vial air space (not into the solution). Injection of air into the air space in the vial prevents creation of negative pressure within the vial, allowing the antigen to be withdrawn easily. Injecting air into the solution creates bubbles and may interfere with withdrawing the correct amount of antigen.²¹
3. The injection should be placed on the palm-side-up surface of the forearm, about two to four inches below the elbow. Your local institutional policy may specify the right or left forearm for the skin test. The area selected should be free of any barriers to placing and reading the skin test, such as muscle margins, heavy hair, veins, sores, tattoos, or scars.
4. After choosing the injection site, clean the area with an alcohol swab by circling from the center of the site outward. Allow the site to dry completely before the injection.
5. Using a disposable tuberculin safety needle and syringe, inject 0.1 ml of PPD tuberculin containing 5 tuberculin units (TU) intradermally with the needle bevel facing upward. Because some of the tuberculin solution can adhere to the inside of the plastic syringe, the skin test should be given as soon as possible after the syringe is filled.
6. The injection should produce a discrete, pale elevation of the skin (a wheal) 6 to 10 mm in diameter. **Note:** If a 6- to 10-mm wheal is not produced, repeat the test on the opposite arm or the same arm, 2 inches from the original site.
7. Record the date and time of TST administration, location of injection site, dose, name of person who administered the test, name and manufacturer of tuberculin product used, lot number, expiration date, and reason for testing.²²

Measurement of the Tuberculin Skin Test

A trained healthcare worker should read the TST 48 to 72 hours after the intradermal injection. Patients should never be allowed to read their own TSTs.²³

- A positive reaction can be measured anytime after 48 hours.
- If the results appear negative and more than 72 hours have passed, the test should be repeated. It can be repeated immediately, or after one week, if two-step testing is required.



A topic titled “Two-Step Tuberculin Skin Testing” will be provided in the Infection Control section of this manual. The section will be available in the Spring of 2007. Check the *Montana Tuberculosis Program Manual* Web page at <http://www.dphhs.mt.gov/PHSD/epidemiology/epi-tuberculosis-manuals.shtml> .



Before you measure a TST, review information in the CDC’s *Mantoux Tuberculin Skin Test Facilitator Guide* at <http://www.cdc.gov/tb/pubs/Mantoux/guide.htm> .

How to Measure a Tuberculin Skin Test

1. Measure the TST site crosswise to the axis of the forearm.
2. Induration is a hard, dense, raised formation. Measure only induration hardness and not swelling around the site of the injection. Do **not** measure erythema (redness). A TST with erythema, but no induration, is nonreactive.
3. Record the test result in mm, not as “positive” or “negative.” An exact reading in mm may be necessary to interpret whether conversions occur on a subsequent test. Record a TST with no induration as “0 mm.” Where there is induration, do not round off the reading, but record it exactly as read.
4. Report adverse reactions to a TST (e.g., blistering, ulcerations, necrosis) to the FDA’s MedWatch Program at 1-800-FDA-1088, or via the Internet at <http://www.fda.gov/medwatch/> .

Interpretation of the Tuberculin Skin Test

TSTs should be interpreted by a trained healthcare worker. Use Table 4 below to interpret TSTs.



Call the local health jurisdiction regarding TST reactions when interpretation and medical follow-up are unclear.



Before you interpret a TST, review information in the CDC's *Mantoux Tuberculin Skin Test Facilitator Guide* at <http://www.cdc.gov/tb/pubs/Mantoux/guide.htm>.

How to Interpret a Tuberculin Skin Test

Use the table below to determine when a reaction is positive.

TABLE 4: POSITIVE TUBERCULIN SKIN TEST REACTIONS

Induration Size	Considered Positive For:
5 mm or more	<ul style="list-style-type: none">▪ Persons with human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS)▪ Recent contacts of an infectious case of tuberculosis (TB) disease▪ Persons with fibrotic lesions on chest radiograph consistent with healed TB▪ Persons with organ transplants or other immunosuppressed persons (such as those receiving the equivalent of >15 mg/day of prednisone for >1 month)▪ Persons receiving treatment with tumor necrosis factor-alpha (TNF-α) antagonists
10 mm or more	<ul style="list-style-type: none">▪ Foreign-born persons recently arrived (within 5 years) from countries with a high TB incidence or prevalence (e.g., most countries in Africa, Asia, Latin America, Eastern Europe, Russia, or from refugee camps)▪ Persons who inject drugs or use other high-risk substances, such as crack cocaine▪ Alcoholics▪ Residents and employees in high-risk, congregate settings (e.g., correctional institutions; long-term residential care facilities, such as nursing homes, mental institutions, etc.; hospitals and other healthcare facilities; homeless shelters; and refugee camps)▪ Mycobacteriology laboratory personnel▪ Persons with other medical conditions that increase the risk of TB disease▪ Children younger than 5 years of age, or children and adolescents exposed to adults in high-risk categories

Induration Size	Considered Positive For:
15 mm or more	<ul style="list-style-type: none"> Persons with no known risk factors for TB

When interpreting TST results, be aware of the following.

Skin test conversions: For persons previously skin tested, an increase in induration of 10 mm or more within a two-year period is classified as a conversion to positive.

False-negative reactions may be due to the following:

- Anergy



See “Anergy Testing” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

- Recent TB infection (within the past 10 weeks)
- Very young age (less than 6 months of age, because the immune system is not fully developed)
- Overwhelming TB disease
- Vaccination with live viruses (e.g., measles, mumps, rubella, varicella, oral polio, or yellow fever).



TB skin testing should be done either on the same day as vaccination with live virus or at least four weeks after vaccination.



See “Live-Virus Vaccines” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

- Some viral infections (measles, mumps, chickenpox, or HIV)
- Corticosteroids or other immunosuppressive agents given for two or more weeks

False-positive reactions may be due to the following:²⁴

- Nontuberculous mycobacteria (NTM) or mycobacterium other than tuberculosis (MOTT)
- BCG vaccination



See “Bacille Calmette-Guérin Vaccine” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

Human Immunodeficiency Virus Screening

The Centers for Disease Control and Prevention (CDC) recommends the following:

- Routine HIV screening for all patients ages 13–64 seeking health care for any reason, without regard to patient's known risks for HIV infection
- Annual HIV screening of patients known to be at high risk²⁵

Follow-Up Activities

After testing, complete the following tasks:



If the person has signs or symptoms of TB, evaluate for TB disease as described in the “Diagnosis of Tuberculosis Disease” topic in the Diagnosis of Tuberculosis Disease section. Refer to Table 3: **When to Suspect Pulmonary Tuberculosis in Adults**.



If the person is a contact, follow the procedures for testing and evaluation in the Contact Investigation section.



If the person is a participant in two-step screening, a topic titled “Two-Step Tuberculin Skin Testing” will be provided in the Infection Control section of this manual. This section will be available in the Spring of 2007. Check the *Montana Tuberculosis Program Manual Web* page at <http://www.dphhs.mt.gov/PHSD/epidemiology/epi-tuberculosis-manuals.shtml>.



If the TST result is positive, a chest radiograph should be obtained for the patient, as specified in the “Chest Radiography” topic in this section.

Chest Radiography

All individuals being considered for LTBI treatment should undergo a chest radiograph to rule out pulmonary TB disease. For information on how to classify TB, see the “Tuberculosis Classification System” topic at the beginning of this section. Refer to Table 5 to determine when to obtain a chest radiograph and what follow-up is required for chest radiograph results.

A posterior-anterior radiograph of the chest is the standard view used for the detection and description of chest abnormalities in adults. In some instances, other views (e.g., lateral, lordotic) or additional studies (e.g., computed tomography [CT] scans) may be necessary.



Children younger than 5 years of age should receive posterior-anterior and lateral radiographs.²⁶



For more information on chest radiography, refer to the Francis J. Curry National Tuberculosis Center's *Radiographic Manifestations of Tuberculosis: A Primer for Clinicians* (Francis J. Curry National Tuberculosis Center Web site; 2006) at http://www.nationaltbcenter.edu/products/product_details.cfm?productID=EDP-04.



For persons recently exposed to TB, follow the procedures for testing and evaluation in the Contact Investigation section.

TABLE 5: TARGETED TESTING FOR LATENT TUBERCULOSIS INFECTION: WHEN CHEST RADIOGRAPHS ARE REQUIRED AND HOW TO FOLLOW UP ON RADIOGRAPHY RESULTS

Signs or Symptoms of TB Disease?	TST or IGRA Result?	Recent Exposure to Infectious TB?	Chest Radiograph?	Follow-up Action
Yes	Positive or negative	Yes or no	Normal or abnormal	<ul style="list-style-type: none">▪ Classify as Class 5.▪ Evaluate for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
No	Negative	No	CXR not recommended unless the patient has HIV infection or other forms of immunosuppression are present	<ul style="list-style-type: none">▪ Classify as Class 0.
No	Positive	No	Normal	<ul style="list-style-type: none">▪ Classify as Class 2.▪ Consider treatment for LTBI. Refer to the Treatment of Latent Tuberculosis Infection section.
			Abnormal: Noncalcified fibrotic lesions suggestive of old, healed TB; comparison film available and stable	<ul style="list-style-type: none">▪ Classify as Class 4 or 5.▪ Consider evaluating for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
			Abnormal: Consistent with TB disease; no comparison film	<ul style="list-style-type: none">▪ Classify as Class 3 or 5.▪ Evaluate for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
Definitions of abbreviations: CXR = chest radiograph; HIV = human immunodeficiency virus; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test.				

Resources and References

Resources

- ATS, CDC, IDSA. "Diagnostic Standards and Classification of Tuberculosis in Adults and Children" (*Am J Respir Crit Care Med* 2000;161[4 Pt 1]). Available at: <http://www.cdc.gov/tb/pubs/PDF/1376.pdf> .
- CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. November 2001. Available at <http://www.cdc.gov/tb/pubs/corecurr/default.htm> .
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site; 1999). Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> .

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54 (No. RR-12):15.
- ² CDC. Classification system. In: Chapter 2: transmission and pathogenesis. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):4–5; CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):7–9, 22.
- ⁴ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):8–9.
- ⁵ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):11–2; CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):13; County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition*:2-1. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf> . Accessed February 6, 2007.
- ⁶ Francis J. Curry National Tuberculosis Center. *Diagnosis and treatment* [Francis J. Curry National Tuberculosis Center Web site]. Available at: http://www.nationaltbcenter.edu/abouttb/diagnosis_and_treatment.cfm . Accessed November 30, 2006.
- ⁷ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):1–2.
- ⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):49.
- ⁹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):50.
- ¹⁰ CDC. Candidates for treatment of latent TB infection. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ¹¹ Sepulveda RL, Ferrer X, Latrach C, Sorensen, RU. The influence of Calmette-Guérin Bacillus immunization on the booster effect of tuberculin testing in healthy young adults. *Am Rev Respir Dis* 1990;142:24–28.
- ¹² McKay, A, Kraut A, Murdzak C, Yassi A. Determinants of tuberculin reactivity among health care workers: interpretation of positivity following BCG vaccination. *Can J Infect Dis* 1999;10:134–139.
- ¹³ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/Chapter9/Tableofcontents.htm> . Accessed January 20, 2007.
- ¹⁴ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/Chapter9/Tableofcontents.htm> . Accessed January 20, 2007.
- ¹⁵ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49[No. RR-6]:11.
- ¹⁶ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: http://www.cdc.gov/nchstp/tb/pubs/corecurr/Chapter9/Chapter_9_Interpretation.htm . Accessed January 20, 2007; Smith PG. Case-control studies of the efficacy of BCG against tuberculosis. In: International Union

-
- Against Tuberculosis, ed. Proceedings of the XXVth IUATLD World Conference on Tuberculosis and Respiratory Diseases. Singapore: Professional Postgraduate Services International 1987:73–9.
- ¹⁷ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm>. Accessed February 6, 2007.
- ¹⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):53.
- ¹⁹ CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S, eds. 9th ed. Washington, DC: Public Health Foundation; 2006:24–25,143.
- ²⁰ CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S, eds. 9th ed. Washington DC: Public Health Foundation;2006:24–25,143.
- ²¹ CDC National Center for Health Statistics. Skin test preparation steps: filling syringes. In: *National Health and Nutrition Examination Survey (NHANES) Manual*. Hyattsville, MD: National Center for Health Statistics.
- ²² CDC. Part two: reading the Mantoux tuberculin skin test. *Mantoux Tuberculin Skin Test Facilitator Guide* [Division of Tuberculosis Elimination Web site]. Available online at: <http://www.cdc.gov/tb/pubs/Mantoux/part2.htm>. Accessed November 30, 2006.
- ²³ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm>. Accessed February 6, 2007.
- ²⁴ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm>. Accessed February 6, 2007.
- ²⁵ CDC. Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health-Care Settings. *MMWR* 2006;55(No. RR-14):1–17.
- ²⁶ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):25.